temperature than many conventional CVD routes. Furthermore, this technique should be completely general to a wide class of ceramic and metal films. For example, by switching the metal halide a very wide variety of thin film materials could be easily grown (see FIG. **12**). Finally, this new technique for thin film growth has the additional benefit that the salt by-products from the reaction are environmentally benign.

As such, an invention has been disclosed in terms of preferred embodiments thereof which fulfill each and every one of the objects of the present invention as set forth above and provides a new and improved apparatus for and a method of forming thin film structures.

Of course, various changes, modifications and alterations from the teachings of the present invention may be contemplated by those skilled in the art without departing from the intended spirit and scope thereof. It is intended that the present invention only be limited by the terms of the appended claims.

What is claimed is:

1. A method of forming a thin film of material on a substrate comprising the steps of:

a) providing a first precursor gas comprising an alkali metal;

b) providing at least one second precursor gas comprising a halide compound gas wherein the halide compound includes at least one component of the material;

c) reacting the first and second precursor gases under gaseous and vacuum conditions of less than 100 torr to form the material and depositing the material on the substrate.

2. The method of claim **1**, wherein the first precursor gas is an alkali metal selected from the group consisting of sodium, potassium, rubidium,and cesium.

3. The method of claim **1**, wherein the halide compound includes metals, non-metals, semiconductors, and combinations thereof.

4. The method of claim **3**, wherein the metal is selected from the group consisting of the Group IIIB, IVB, VB, VIB, VIIB, VIIIB, IA, IIA, IIIA, IVA, VA, and VIA elements and combinations thereof.

5. The method of claim **1**, wherein the halide compound is selected from the group consisting of boron, C, S; and Groups VA, and VIA elements.

6. The method of claim **1**, wherein the halide compound includes a halogen element selected from the group consisting of chlorine, fluorine, bromine and iodine.

7. The method of claim **1**, further comprising providing a carrier gas as part of said reacting step.

8. The method of claim **7**, wherein the carrier gas is one of a non-reactive and a reactive gas.

9. The method of claim **7**, wherein the carrier gas is included as part of each of the first and second precursor gases.

10. The method of claim **7**, wherein the carrier gas is one of oxygen, nitrogen, helium, and argon.

11. The method of claim **1**, wherein the first and second precursor gases are arranged as dual flow streams prior to the reacting step.

12. The method of claim **11**, wherein a separator gas is provided between the dual flow streams prior to the reacting step.

13. The method of claim **1**, wherein the first precursor gas is sodium and the at least one second precursor halide compound gas is selected from the group consisting of $TiCl_4$, $SiCl_4$, $SiHCl_3$, $TaCl_5$, BCl_3, CCl_4, and combinations thereof.

14. The method of claim **13**, wherein each of the first and second precursor gases include one of argon, oxygen, helium, and nitrogen.

15. The method of claim **1**, wherein the reacting step is performed at an elevated temperature less than 900° C.

16. A method of forming a thin film of material on a substrate comprising the steps of:

a) providing a first precursor gas comprising an alkali metal;

b) providing at least one second precursor gas comprising a halide compound gas wherein the halide compound includes at least one component of the material;

c) reacting the first and second precursor gases under gaseous conditions at an elevated temperature and less than 100 torr to form the material and depositing the material on the substrate.

17. The method of claim **16**, wherein the alkali metal is selected from the group consisting of sodium, potassium, rubidium, and cesium, the halide compound includes metals, non-metals, and combinations thereof.

18. The method of claim **17**, wherein the first precursor gas is sodium and the halide compound is selected from the group consisting of $TiCl_4$, $SiCl_4$, $SiHCl_3$, $TaCl_5$, BCl_3, CCl_4, and combinations thereof.

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